A Building Method and Mould Units

The present invention is concerned with an improved method of building structures such as houses.

Conventional house constructions requires the employment of numerous skilled artisans such as bricklayers, carpenters, plumbers and electricians. It is an object of the present invention to provide a building construction method and apparatus which at least reduces the demand for such skills. It is a further object of the present invention to provide a method of construction which allows a building to be constructed in minimal time but with excellent structural properties in terms of strength, heat capacity and precision of construction. It is an object of the present invention that the method and apparatus is economic even for one-off constructions.

Accordingly the present invention provides a mould unit for use in a method of constructing a building, said unit being formed from injection moulded plastics and comprising a pair of opposing solid side walls connected by opposing parallel end walls, apertures in each end wall, a shoulder extending inwardly and around the upper edge of each of said side walls including a "V" notch groove to receive a "V" shaped bottom edge of a further mould unit in an overlying course of mould units and wherein reinforcing formers extend at spaced intervals between the side walls to prevent the side walls bowing out when the mould is filled with a setting composition, each former being provided with a "V" notch groove to receive the lower edge of an overlying mould unit and wherein the formers are each of similar shape to the end walls so that the mould unit can be cut down in size.

The use of a mould unit according to any one of claims 1 to 6 in a method of constructing a building comprising the steps of:

(i) laying the foundations,

(ii) assembling a wall or part of a wall from the mould units,

(iii) feeding utilities through the assembled or part assembled wall of hollow mould units, and after installation of the utilities,

(iv) filling the assembled mould units with a setting composition.

The step of laying the foundations or footings is substantially conventional. However, initially each wall of the building is formed from the mould units. Each mould unit is preferably similar. The opposing side walls may be rectangular. Both the side walls and the end walls are preferably disposed upright in use. The shoulder extending around the uppermost edges of the side and end walls provides reinforcement for the rectangular sectioned mould and provides a surface for the support of overlying courses of the moulds. Openings are provided in the top, bottom and end walls of the mould. The "V" shaped groove formed into the shoulder helps to achieve accurate alignment of the moulds as they are stacked in courses. The bottom edge of each wall preferably has a corresponding wedge shape to locate tightly and sealingly into the "V" shaped groove.

To assist in locating the overlying courses of moulds and to further reinforce the mould so that it retains its shape, a flange extends up from the inner edge of the shoulder. The flange may be inclined inwardly so that the lower edges of an upper mould being lowered onto the mould are guided onto the shoulder. The flange may conveniently include slots running parallel to the end walls to accurately align the overlying mould as it is lowered, offset, onto an underlying mould.

The moulds are of standard sizes so that standard sized holes for the reception of doors and windows can readily be incorporated into the wall. Formers are provided within each mould unit of similar shape to the end walls and extending between the side walls at spaced intervals. The formers allow any mould unit to be cut down in size. Preferably three formers are provided at equally spaced

intervals. The dimensions of each mould unit are preferably in the ratio of: length = twice height = four times depth. Thus with three equally spaced formers the mould can readily be divided into half or quarter sizes.

The openings formed in the mould are made of sufficient size that utilities are readily run through the openings within the mould as the wall is assembled. Utilities in this context refers at least to electrical wiring, pipe work for central heating, water supply and wastewater, gas supply, communications services such as telephones, networking, alarm systems, and control for closing and central locking the doors and windows. Utilities may be run in ducts set into the walls to permit subsequent modification and repair. Knock out panels may conveniently be provided in the side walls of each mould to provide terminals appropriate to the various services, for example, wall boxes for wiring and couplings for gas and water plumbing.

When the utilities have been run through the walls the outer wall may be surfaced with insulation board, such as Kingspan board and finished as desired by rendering, with a brick wall or curtain. The inner wall may be clad with plaster board. The thin plastics material of the mould units allows the board to be easily and quickly secured via screws selected to project well into the cavity of each mould unit. Finally the moulds are filled with a setting composition such as concrete or foamed concrete.

The moulds are preferably formed from injection moulded plastics. When the setting composition has set the outer surface of the mould can be finished by plastering and or attachment of a suitable form of insulating board. The external surface may be painted or rendered.

The method and apparatus is particularly well suited to building design via computer wherein the building is designed to include the wall and floor lay out and the number and location of each of the utility outlets, doors and windows. The

program then generates a list of mould units required to assemble the building together with the precise location, routing and terminations of the utilities.

Because the moulds locate accurately one against another, the skills of a bricklayer are obviated and a wall can be assembled by a technician trained to follow the computer generated instructions. Similarly the skills of an electrician or plumber are obviated. Because of the precision of the mould units the size of door and window frames is precisely determined and accurate fitting of prefabricated door and window frames becomes very simple.

A building method and apparatus constructed in accordance with the present invention will now be described by way of example only, with reference to the accompanying figures, in which:

Figure 1 shows a perspective view of a mould unit of the present invention,

Figure 2A shows a side view of the mould unit of figure 1,

Figure 2B shows a plan view from above, of the mould unit,

Figure 2C shows an end view of the mould unit of figure 1,

Figure 2D shows a detail through the upper edge of a wall of the mould unit, and

Figure 3 shows a perspective view of a wall partly assembled from mould units of the embodiment.

As shown in the drawings a mould unit is formed from injection moulded plastics and comprises a pair of similar upright parallel opposing solid side walls 1 joined at their ends by parallel opposing end walls 2. Each side wall is 500mm long, and 225mm high (three times the height of a common brick). The end walls are of similar height and 125mm deep so that the dimensions of the mould unit are: length = four times depth.

Each side wall is provided with three knock-out panels 3,3'. Each knock out panel is defined by a groove or otherwise weakened portion extending around the periphery of the panel so that the panel can be easily cut from or knocked out of the wall. The knock out panel 3 is centred on the block and sized to receive a double wall box. The two knock out panels 3' are sized to receive a single gang wall box and are preferably located on each to either side of the central panel 3.

The upper edge of each wall is provided with a shoulder 4 which is shown in detail in figure 2D. The shoulder 4 is formed with a "V" sectioned groove 4' in it. The bottom of each wall is formed as a tapered "V" wedge 5 sized and shaped to fit closely and sealingly into the groove 4' as shown. This achieves the effect of accurately aligning the moulds in courses and ensures that the pressure of the concrete setting composition with which the moulds are eventually filled does not force the edges of the walls apart so causing leakage of the concrete and deterioration of the quality of the wall finish.

Extending up from the inner edge of the shoulder 4 is a flange 6 which has a first part 6' rising vertically to abut the lower edge of the wall 5 and improve the sealing effect and a second part 6" which is inclined so that the bottom of the overlying wall 5 is guided into the groove with ease during construction of the wall. The flange has a further reinforcing horizontal part 6"' which defines the upper opening of the mould. Three parallel slots 7 are formed extending laterally through the flange 6 to locate the lower edge of an end wall of a mould forming an overlying course so that the overlying course is accurately aligned. The slots 7 are twice the wall thickness wide, in this example the walls are 2mm thick.

Each end wall has an opening 8 formed into it. The size of the opening 8 is optimised to provide for through flow of filler and to readily permit the passage of utilities and associated ducts by forming the opening as a cut out bounded only by

two opposing converging side edges which rise from the botom edge of the end wall 2 to arch over and meet near the top of the end wall. This would ordinarily allow the side walls to bow outward under pressure from the filler, however, the interengagement of the bottom of the side walls of an overlying course of moulds with a groove in an underlying course prevents this occuring. Three internal reinforcing formers 9 of similar shape to the end walls 2 are provided spanning between the side walls at equally spaced intervals. These help to prevent the side walls bowing out under the pressure of filler and also allow the mould unit to be cut down to three quarters, half or quarter size with the remaining former providing a new end wall. As with the side and end walls a shoulder 4 is provided on the top surface of the former and the "V" notch groove 4' is extended into the shoulder on the former 9 as shown in figure 2B. Because the slots 7 are twice as thick as the formers 9 the formers 9 are set to one side of the gap 7 so that is convenient to cut the mould unit down the side of the former 9 and the former acts as a straight guide for the cutting tool.

The bottom edge of the end walls 2 and the formers 9 are slightly above the lower edge of the side walls 1 to allow the side walls to locate in the groove 4'.

The surface of the side wall may be finished with a keyed surface allowing the wall to be finished by rendering, or tiling. Vertically spaced ribs can be formed onto the side wall surface to provide guides for tiling with decorative and or insulating tiles.

The method of building comprises the first step of designing the building. This is preferably computer assisted in that the layout and dimensions of the walls are determined in units corresponding to the mould size. Taking account of the function of each room and the location of windows and doors, the desired location of utilities such as; sockets for electrical and communications outlets and connections

for closed and open circuit water supplies for heating are established. The program than calculates the size and shape of the footings, the required number of mould units, the required materials for the utilities (e.g. the length of cable, ducting pipe and number and type of connections required) and a set of plans and instructions for assembling the moulds and installing the utilities.

When the plans are complete the footings are laid in substantially conventional manner. The moulds are then delivered and assembled in accordance with detailed instructions as illustrated in figure 3. As the moulds are assembled the utilities 9 are threaded through the apertures in the top, bottom and ends of the mould units and connected to appropriate connectors mounted into holes formed by the selective removal of knock outs 3. End pieces (not shown) are used to close off any exposed apertures in the end walls.

When the assembly of the wall and utilities is complete and has been checked an insulating board such as Kingspan board is screwed onto the external wall surface with screws of sufficient length to project well into the mould unit cavities. Similarly plasterboard may be screwed into the internal wall surface. Window and door assemblies may be similarly installed by screwing the window or door frames into the mould units where apertures are provided for the frames. Finally a setting filler such as foamed concrete is injected into the mould assembly to fill the wall and allowed to set. The filler will engage the screw ends so retaining the boards and frames. Similarly ducting, cable and pipe work is supported and protected by the filler. The exposed surfaces of the formed wall can then be decorated by painting, plastering, rendering and/or tiling.

The process has the great advantage of obviating the requirement, at least to a very great extent of skilled artisans such as bricklayers, carpenters, plumbers and electricians.